

501,337

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization  
International Bureau



23 JUL 2004



(43) International Publication Date  
31 July 2003 (31.07.2003)

PCT

(10) International Publication Number  
**WO 03/061408 A1**

(51) International Patent Classification<sup>7</sup>: **A23L 3/18**,  
1/216, 1/212

**LUSARDI, Roberto** [IT/IT]; Via Pelacani, 4, I-43100  
Parma (IT). **PACIELLO, Gerardo** [IT/IT]; Vico 3°  
Mazzini, 7, I-85010 Pignola (IT).

(21) International Application Number: PCT/IT02/00690

(74) Agent: **GOTRA, Stefano**; Bugnion S.p.A, Via Garibaldi,  
22, I-43100 Parma (IT).

(22) International Filing Date: 29 October 2002 (29.10.2002)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
PR02A000001 24 January 2002 (24.01.2002) IT

(81) Designated States (*national*): AE, AG, AL, AM, AT, AU,  
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,  
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,  
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,  
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,  
MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG,  
SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, US, UZ,  
VN, YU, ZA, ZM, ZW.

(71) Applicant (*for all designated States except US*): **SIG  
MANZINI S.P.A.** [IT/IT]; Via Paradigna, 94/A, I-43100  
Parma (IT).

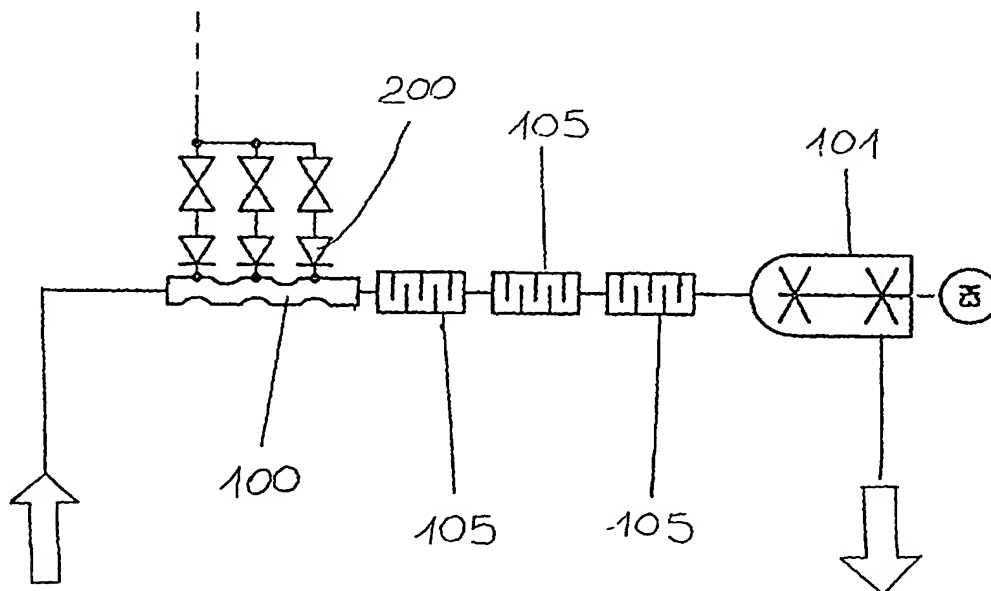
(84) Designated States (*regional*): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW),  
Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM),  
European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE,  
ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK,  
TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ,  
GW, ML, MR, NE, SN, TD, TG).

(72) Inventors; and

(75) Inventors/Applicants (*for US only*): **ARELLI, Pier-  
luigi** [IT/IT]; Stradello Pramori, 1, I-43100 Parma (IT).

[Continued on next page]

(54) Title: METHOD FOR STERILISING FOOD PRODUCTS, BY INJECTED STEAM, IN PARTICULAR PUREES AND/OR CONCENTRATES



(57) Abstract: Method for sterilising food products, in particular purees and/or concentrates, of the type comprising at least a step of heating the product by injection of steam at predetermined temperature and at least a step of mixing the product to allow a substantially uniform distribution of the steam. Said mixing step originally takes place by means of at least a dynamic mixer. A possible dynamic mixer able to implement said mixing step comprises at least a tank for collecting the product, at least an agitator associated with the tank and operatively active on the product to mix it and means for actuating the agitator.



WO 03/061408 A1

**Declarations under Rule 4.17:**

- as to applicant's entitlement to apply for and be granted a patent (Rule 4.17(ii)) for the following designations AE, AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW, MX, MZ, NO, NZ, OM, PH, PL, PT, RO, RU, SD, SE, SG, SI, SK, SL, TJ, TM, TN, TR, TT, TZ, UA, UG, UZ, VN, YU, ZA, ZM, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZM, ZW), Eurasian patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European patent (AT, BE, BG, CH, CY, CZ, DE, DK, EE, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, SK, TR), OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW, ML, MR, NE, SN, TD, TG)

- as to the applicant's entitlement to claim the priority of the earlier application (Rule 4.17(iii)) for the following designation US
- of inventorship (Rule 4.17(iv)) for US only

**Published:**

- with international search report

*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

METHOD FOR STERILISING FOOD PRODUCTS BY INJECTED STEAM, IN PARTICULAR PUREES AND/OR CONCENTRATES

TECHNICAL FIELD AND BACKGROUND ART.

5 The present invention relates to a method for sterilising food products, in particular purees and/or concentrates, of the type comprising a step of heating the product by injecting steam at predetermined steam and a step of mixing the product, to allow a uniform distribution of the steam and consequently a heating that is as homogeneous as possible.

10 Currently, such a type of method is particularly adopted in the food sector of the manufacture of juices and/or concentrates of fruit and/or vegetables, such as tomatoes.

A first known method provides for the heating to take place by means of a pair of coaxial conduits. In particular, the smaller-diameter conduit, within  
15 which flows the product to be heated, is externally lapped by a heating fluid that flows in the larger-diameter conduit.

A heating operated according to said procedures has the drawback of heating effectively only the mass of product that is in direct contact with the walls of the inner conduit that are lapped by the heating fluid. Therefore, the mass of  
20 product that is substantially in correspondence with the centreline of the inner conduit undergoes an insufficient heating to assure the sterility of the product.

In accordance with a second known method, the product is heated by injecting hot steam into it. While this method does allow for better heating than the first method, it nonetheless has the drawback of not assuring  
25 temperature stability within the product.

In particular, areas of products with insufficient temperature may be created, thereby compromising the asepsis of the final product. It is not possible to obtain a uniform distribution of the steam inside the product due to the different physical state of the steam and of the product itself, normally  
5 respectively gaseous and liquid.

To overcome this drawback, the product is heated to a higher temperature than the one actually required to guarantee sterilisation, so that, even in the presence of temperature variations, the temperature of the product never drops below a minimum value that guarantees its asepsis. However,  
10 overheating entails the additional problem of deteriorating the quality of the product, changing its chemical-physical characteristics, such as taste, viscosity and/or consistency.

According to a third known method, the product is made to advance inside a conduit having, on its outer lateral walls, a plurality of recesses whereto  
15 correspond an equal number of projections on the inner lateral walls, which thus are undulated. During its advance inside the conduit, the product is heated by injection of hot steam and, by effect of the turbulence generated by the undulation of the inner walls of the conduit, the product undergoes a mixing that should favour a uniform distribution of the steam and  
20 consequently a homogeneous heating.

The method described above has the important drawback of being sensitive to the mass flow rate of the product. In particular, a different mass flow rate from the one for which the conduit was dimensioned influences the turbulence generated by the inner walls of the conduit and therefore does not  
25 allow a uniform distribution of the steam, favouring temperature variations.

An additional drawback, therefore, is represented by the impossibility of throttling the plant, without compromising the asepsis of the product at the end of the treatment.

#### DISCLOSURE OF INVENTION.

- 5 An aim of the present invention is to eliminate the aforesaid drawbacks making available a method for sterilising food products, in particular purees and/or concentrates, which allows uniformly to heat the product to be treated, without any deterioration of its quality.

An additional aim of the present invention is to propose a sterilising method  
10 that allows to throttle the plant, without compromising the asepsis of the final product.

Another aim of the present invention is make available a method that allows a chemical-physical homogenisation of the product, drastically reducing its degradation.

- 15 A further aim of the present invention is to propose a sterilisation method that is simple and economical to implement.

Said aims are fully achieved by the method for sterilising food products, in particular purees and/or concentrates, of the present invention, which is characterised by the content of the claims set out below and in particular in  
20 that the method provides for executing the mixing step by means of at least a dynamic mixer.

#### BRIEF DESCRIPTION OF DRAWINGS.

This and other characteristics shall become more readily apparent from the following description of a preferred embodiment of the method illustrated,  
25 purely by way of non limiting example, in the accompanying drawing tables,

in which:

- Figure 1 shows a portion of an embodiment of a plant for sterilising food product that implements a method according to the invention;
- Figure 2 shows a partially sectioned lateral view of a first constructive detail of the plant of Figure 1;
- Figure 3 shows a partially sectioned axonometric view of a second constructive detail of the plant of Figure 1.

#### BEST MODE FOR CARRYING OUT THE INVENTION.

The method of the invention is of the type comprising at least a step of heating the product by injecting steam at predetermined temperature; in particular, the steam must be sufficiently hot to guarantee the asepsis of the product at the end of the treatment.

The method comprises at least a step of mixing the product, in order to enable a uniform distribution of the steam and consequently an equal heating of the product itself.

Said mixing step originally takes place by means of at least a dynamic mixer. Figure 2 shows, purely by way of example, a possible embodiment of a dynamic mixer able to carry out the aforesaid mixing step in accordance with the method.

With reference to Figure 2, the dynamic mixer is globally indicated with the number 1 and comprises a tank 2 for collecting the product, typically food puree or concentrate, an agitator 3 inserted in the tank to mix the product to be sterilised and means 4 for actuating the agitator. In particular, said means preferably comprise an electric motor.

The method also comprises a step of mixing the product by means of at least

a static mixer.

Figure 3 shows, purely by way of example, a possible embodiment of a static mixer able to carry out the aforesaid mixing step in accordance with the method.

- 5 With reference to Figure 3, the static mixer is globally indicated with the number 5 and comprises a tubular body 6 inside which flows the product, typically food puree or concentrate, a plurality of fixed baffles 7, positioned inside the tubular body and so shaped as to operate continuous deviations of the product and separation of the threads, to allow its mixing by effect of the
- 10 turbulence that develops.

Figure 1 shows a possible embodiment of the method according to the invention.

- The product flows inside a conduit 100, which has undulated inner walls in accordance with the prior art and is provided with a plurality of steam
- 15 injectors 200.

Subsequently, the heated product flows inside one or more static mixers 105, which perform a first coarse mixing to uniform the temperature of the product.

- Thereafter, the pre-mixed product reaches a dynamic mixer 101 which
- 20 performs a fine mixing, uniforming the temperature of the product and assuring its sterilisation.

- According to an embodiment variation, the heating and mixing steps can be simultaneous. In this case, the steam injection takes place by means of a plurality of nozzles preferably associated directly to the dynamic mixer,
- 25 thereby obtaining a single processing stage.

The method of the invention achieves important advantages.

First of all, such a method allows to heat the product in uniform fashion, assuring temperature stability and guaranteeing asepsis. In particular, the use of a dynamic mixer allows a chemical-physical homogenisation of the product, drastically reducing its degradation and safeguarding the organoleptic characteristics such as taste and colour, or the physical characteristics, such as viscosity and consistency.

Secondly, a mixing step carried out by means of dynamic mixers allows to throttle the plant, without compromising a uniform temperature distribution inside the product and thus guaranteeing the asepsis of the final product.

Advantageously, said method is simple and economical to implement and can be used to sterilise even products with high viscosity.

Another advantage is represented by the fact that, given the presence of dynamic mixers, the static mixers and the undulated conduits into which the steam is injected can have reduced length, since the turbulence created by them in the product is not the sole source of mixing action. Thanks to conduits of reduced length, therefore, it is possible to reduce head losses inside the plant, achieving considerable energy savings and lower pressures of the injected steam. This is even more readily apparent if the heating step is simultaneous with the mixing step and both take place inside a dynamic mixer, in accordance with the described embodiment variation.



## CLAIMS

1. Method for sterilising food products, in particular purees and/or concentrates, comprising the steps of:  
heating the product by injection of steam at predetermined temperature;  
5 mixing the product to allow a substantially uniform distribution of the steam;  
characterised in that the mixing step takes place by means of at least a dynamic mixer.
2. Method as claimed in claim 1, characterised in that the dynamic mixer comprises:  
10 at least a tank for collecting the product;  
at least an agitator associated with the tank and operatively active on the product to mix it;  
means for actuating the agitator.
3. Method as claimed in claim 1, characterised in that it further comprises  
15 a step of mixing the product by means of at least a static mixer.
4. Method as claimed in claim 3, characterised in that the static mixer comprises:  
at least a tubular body within which the product flows;  
a plurality of fixed baffles, positioned inside the tubular body and so shaped  
20 as to operate continuous deviations of the product, to allow its mixing.
5. Method as claimed in claim 1, characterised in that the heating and mixing steps are simultaneous.
6. Method as claimed in claim 5, characterised in that the steam injection takes place by means of a plurality of nozzles directly associated with the  
25 dynamic mixer.

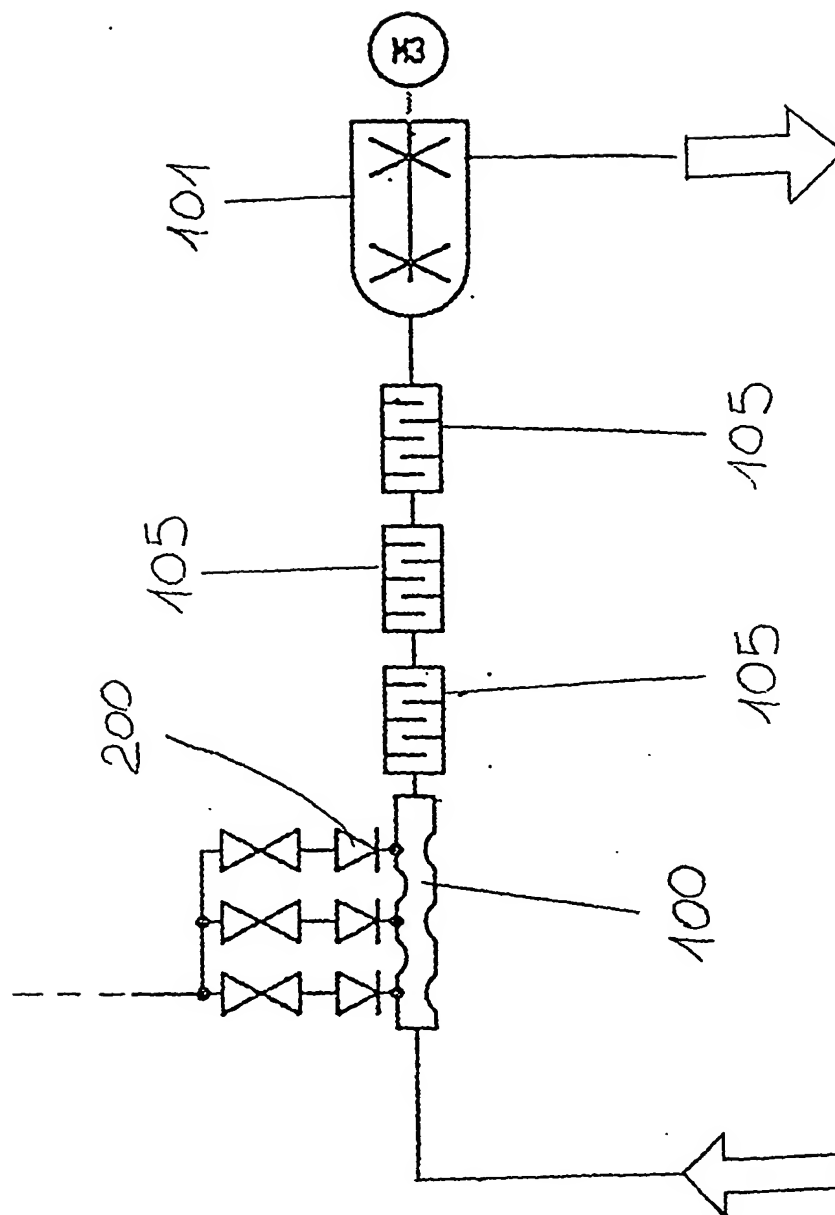


FIG. 1

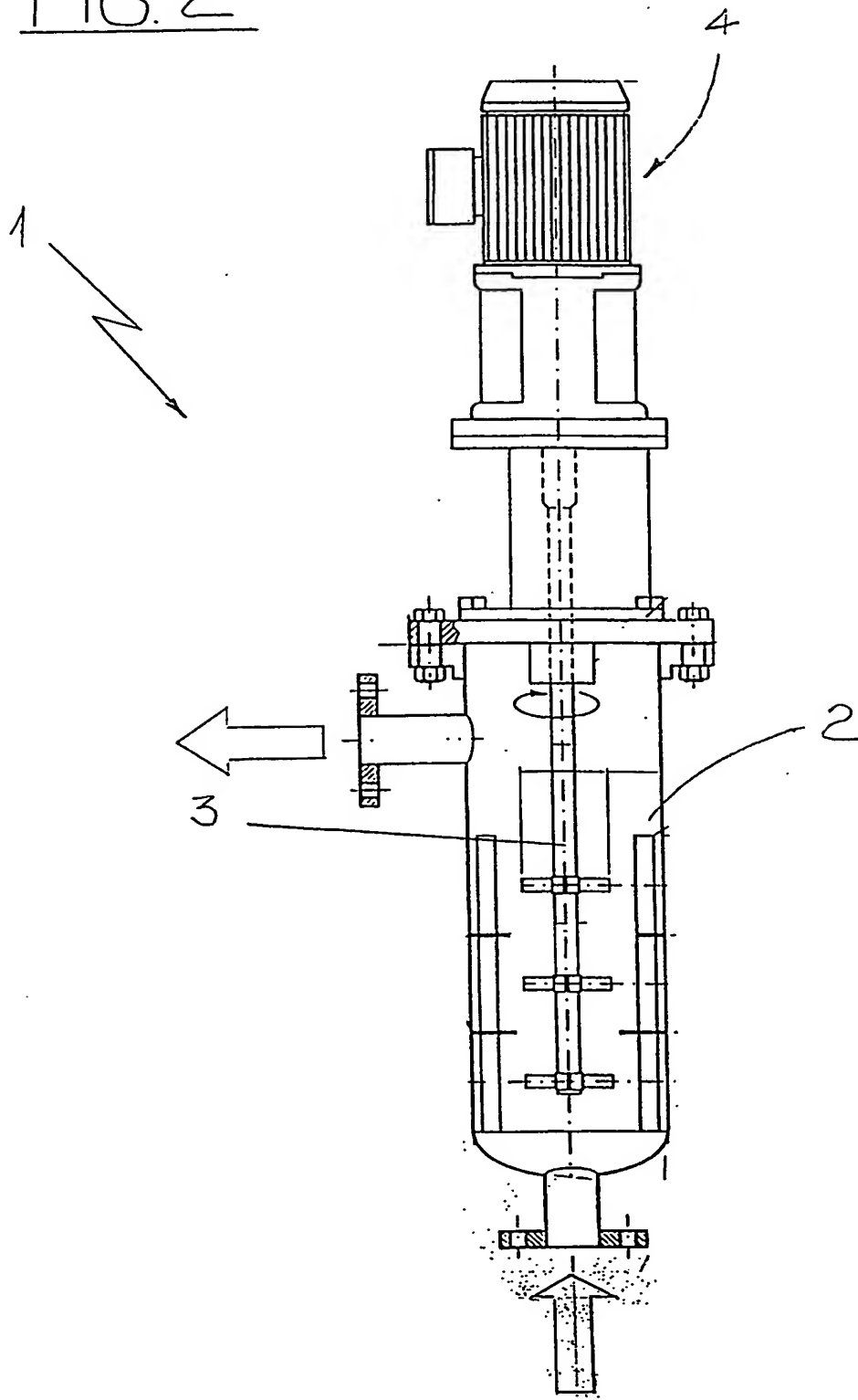
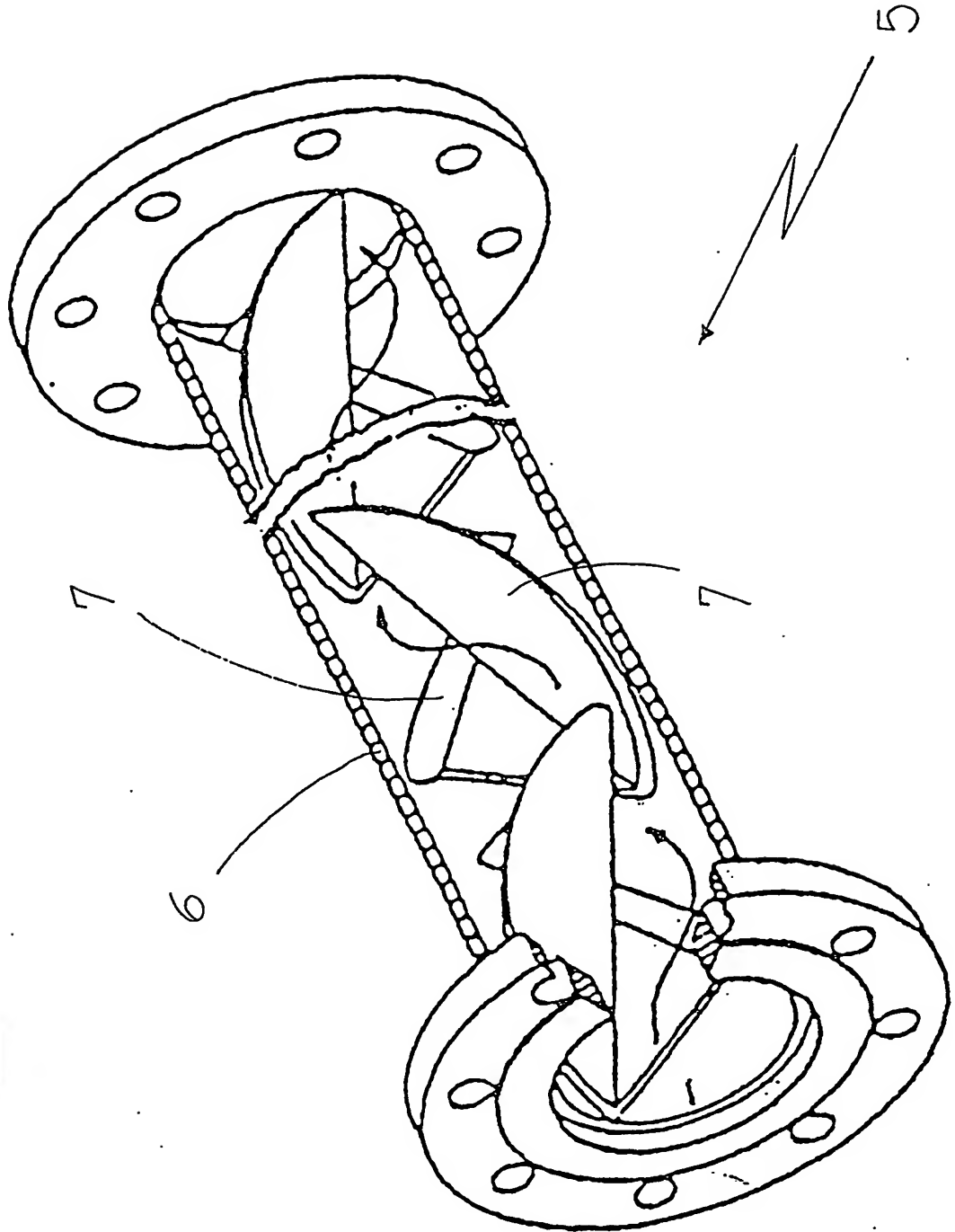
FIG. 2

FIG. 3



## INTERNATIONAL SEARCH REPORT

International Application No.

PCT/IT 0690

## A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A23L3/18 A23L1/216 A23L1/212

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A23C A23K A23L A23B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	EP 0 780 056 A (NESTLE SA) 25 June 1997 (1997-06-25) page 2, line 50 - page 3, line 6; figures page 2, line 9 - line 25 ---	1,2,5,6
X	GB 1 550 434 A (KRAFTCO CORP) 15 August 1979 (1979-08-15) page 4, line 10 - line 16 page 1, line 59 - line 91 page 3, line 46 - line 123; figures ---	1-5
X	DE 199 02 610 C (STEPHAN & SOEHNE) 8 June 2000 (2000-06-08) column 1, line 1 - line 12; claims 1,6 --- -/--	1,2,5,6

☒ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

## \* Special categories of cited documents:

- \*A\* document defining the general state of the art which is not considered to be of particular relevance
- \*E\* earlier document but published on or after the international filing date
- \*L\* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- \*O\* document referring to an oral disclosure, use, exhibition or other means
- \*P\* document published prior to the international filing date but later than the priority date claimed

- \*T\* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- \*X\* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- \*Y\* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- \*G\* document member of the same patent family

Date of the actual completion of the international search

5 February 2003

Date of mailing of the international search report

05/03/2003

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

Guyon, R

## INTERNATIONAL SEARCH REPORT

International Publication No

PCT/IT 0690

## C.(Continuation) DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	GB 264 278 A (HARRY CHARLES DAVIS;MOLASSINE COMPANY LTD) 20 January 1927 (1927-01-20) the whole document ----	1,2,5,6
X	EP 0 403 137 A (GEN FOODS INC) 19 December 1990 (1990-12-19) page 5, line 40 - line 49; figure 1 page 6, line 53 - line 55 page 5, line 56 - line 58 ----	1-6
X	US 5 906 853 A (SMITH GARY F) 25 May 1999 (1999-05-25) column 1, line 37 - line 67; figures -----	1,2,5,6

# INTERNATIONAL SEARCH REPORT

Information on patent family members

International Publication No

PCT/IT 00000690

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0780056	A	25-06-1997	EP 0780056 A1	25-06-1997
			AP 719 A	07-01-1999
			AU 718910 B2	20-04-2000
			AU 7643196 A	26-06-1997
			BR 9606136 A	03-11-1998
			CN 1159304 A ,B	17-09-1997
			EG 21250 A	30-04-2001
			NO 965500 A	23-06-1997
			PL 317637 A1	23-06-1997
			SG 77586 A1	16-01-2001
			US 6120176 A	19-09-2000
			US 5863587 A	26-01-1999
			ZA 9610726 A	21-09-1998
<hr/>				
GB 1550434	A	15-08-1979	AU 504697 B2	25-10-1979
			AU 1703376 A	23-02-1978
			BE 845717 A1	16-12-1976
			CA 1089702 A1	18-11-1980
			US 4112131 A	05-09-1978
<hr/>				
DE 19902610	C	08-06-2000	DE 19902610 C1	08-06-2000
<hr/>				
GB 264278	A	20-01-1927	NONE	
<hr/>				
EP 0403137	A	19-12-1990	AU 628586 B2	17-09-1992
			AU 5717490 A	20-12-1990
			CA 2017643 A1	14-12-1990
			EP 0403137 A2	19-12-1990
			JP 3067543 A	22-03-1991
			NZ 234016 A	26-03-1993
			NZ 243260 A	26-03-1993
			US 5104675 A	14-04-1992
<hr/>				
US 5906853	A	25-05-1999	US 5996475 A	07-12-1999
			CA 2224033 A1	13-06-1998
			EP 0847689 A1	17-06-1998
<hr/>				